



Forecasting at JTWC



Major Steve Gruber
JTWC Technique Development



For a PPT Version of this presentation



JTWC Operations



- Governed by USCOMPAC instruction 3140.1(series), tropical cyclone operations manual
 - ▶ Also sets special observation requirements for U. S. Military weather stations when a tropical passes within 150nm
- Manned with 30 military and civilian positions
 - ▶ 17 Air Force 13 Navy
- Air force provides reconnaissance and forecasters
- Navy provides facility, equipment and forecasters



Products



- Daily - Significant Weather Advisory
- Prewarning - Tropical Cyclone Formation Alert (TCFA)
- Warning
 - ▶ Warning message
 - ▶ Warning graphics
 - ▶ Prognostic reasoning message
- Limited distribution items
 - ▶ Forecast aids
 - ▶ Conference call



Watch Team

- 24/7
- TDO
 - ▶ O-3/O-4
- Sat Ops
 - ▶ E-5/E-6
- TDA
 - ▶ E-3/E-5





JTWC Forecast Process

0500 L Watch Turnover

Perform streamline analyses, look for suspect areas, review old data and previous forecasts, issue sig wx bulletin(s)

0745L Metcon

0800 L Start 1800 UTC Warning

1030 L Issue 1800 Z Warning

1200 L Metwatch

1400 L Start Over. 2nd Cycle

Warning Crunch

Review fixes

Update BT

Send Bogus

Create Consensus

SAFA Analysis

Intensity Assessment

Wind Radii

Create Warnings

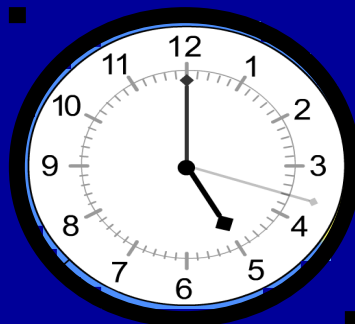
Issue Warnings x2 or x3

5 Day Aids

Customer Calls

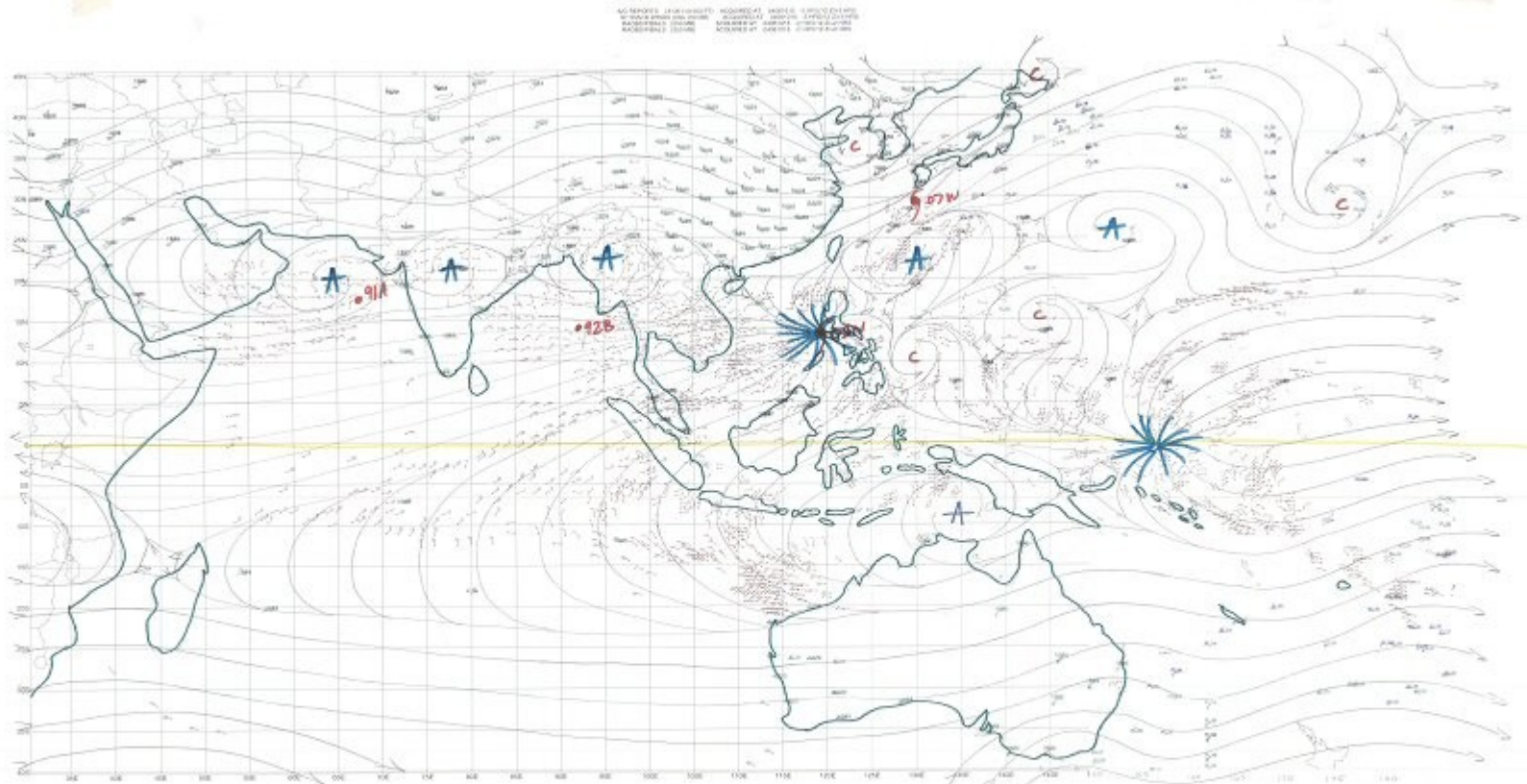
Conference Calls

"TIME IS THE ENEMY"



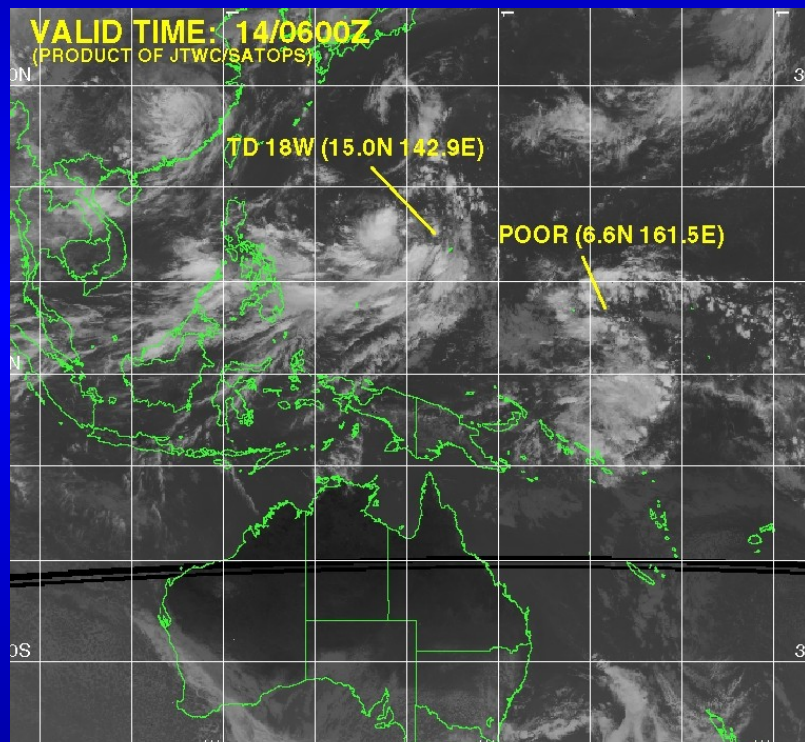


Streamline Analysis Sfc & UA





Evaluate Suspect Areas/ABXX



ABPW10 PGTW 140600

MSGID/GENADMIN/NAVPACMETOCCEN PEARL HARBOR HI/JTWC//
SUBJ/SIGNIFICANT TROPICAL WEATHER ADVISORY FOR THE WESTERN
/AND SOUTH PACIFIC OCEAN/140600Z-150600Z AUG 2004//
REF/A/MSG/NAVPACMETOCCEN PEARL HARBOR HI/140151Z AUG 2004//
AMPN/REF A IS A TROPICAL CYCLONE WARNING.//
RMKS/

1. WESTERN NORTH PACIFIC AREA (180 TO MALAY PENINSULA):

A. TROPICAL CYCLONE SUMMARY:

(1) AT 140000Z, TROPICAL DEPRESSION (TD) 18W WAS LOCATED NEAR 15.0N 142.9E, APPROXIMATELY 150 NM NORTHWEST OF GUAM, HAS TRACKED WEST-NORTHWESTWARD AT 08 KNOTS OVER THE PAST 06 HOURS. MAXIMUM SUSTAINED WINDS WERE ESTIMATED AT 25 KNOTS GUSTING TO 35 KNOTS. SEE REF A (WTPN31 PGTW 140300) FOR FURTHER DETAILS.

(2) NO OTHER TROPICAL CYCLONES.

B. TROPICAL DISTURBANCE SUMMARY:

(1) THE AREA OF CONVECTION PREVIOUSLY LOCATED NEAR 14.5N 144.5E, IS NOW THE SUBJECT OF A TROPICAL DEPRESSION WARNING. SEE PARA 1.A.(1) FOR DETAILS.

(2) THE AREA OF CONVECTION PREVIOUSLY LOCATED NEAR 6.5N 161.7E IS NOW LOCATED NEAR 6.6N 161.5E, APPROXIMATELY 200 NM EAST OF POHNPEI. ANIMATED MULTISPECTRAL SATELLITE IMAGERY REVEALS INCREASING CONVECTION IN ASSOCIATION WITH A POSSIBLE WEAK LOW LEVEL CIRCULATION CENTER. UPPER LEVEL ANALYSIS INDICATES WEAK TO MODERATE VERTICAL WIND SHEAR AND FAVORABLE DIVERGENCE. MAXIMUM SURFACE WINDS ARE ESTIMATED AT 10 TO 15 KNOTS. MINIMUM SEA LEVEL PRESSURE IS ESTIMATED TO BE NEAR 1008 MB. THE POTENTIAL FOR THE DEVELOPMENT OF A SIGNIFICANT TROPICAL CYCLONE WITHIN THE NEXT 24 HOURS REMAINS POOR.

(3) NO OTHER SUSPECT AREAS.

2. SOUTH PACIFIC AREA (WEST COAST OF SOUTH AMERICA TO 135 EAST):

A. TROPICAL CYCLONE SUMMARY: NONE.

B. TROPICAL DISTURBANCE SUMMARY: NONE.

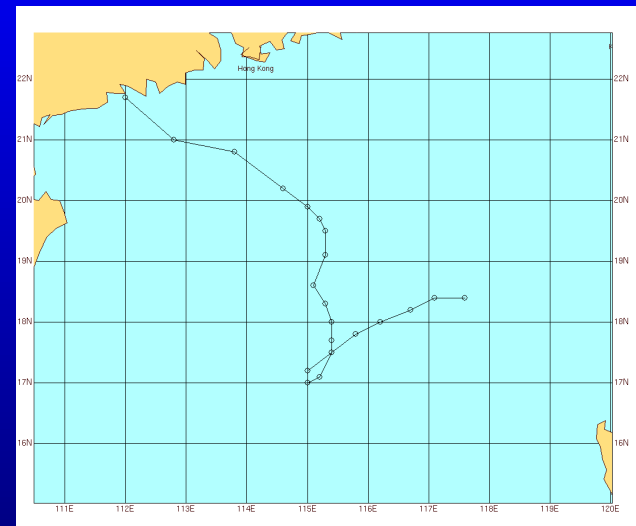
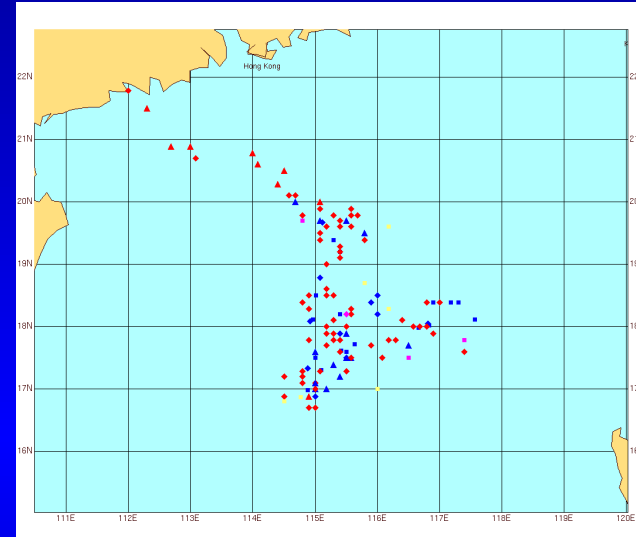
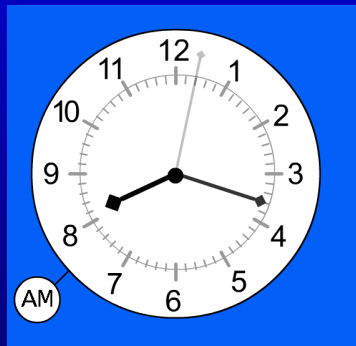
FORECAST TEAM: DIXON/BOWER/MENEBROKER/FUNK//
NNNN



Best Track...Art or Science

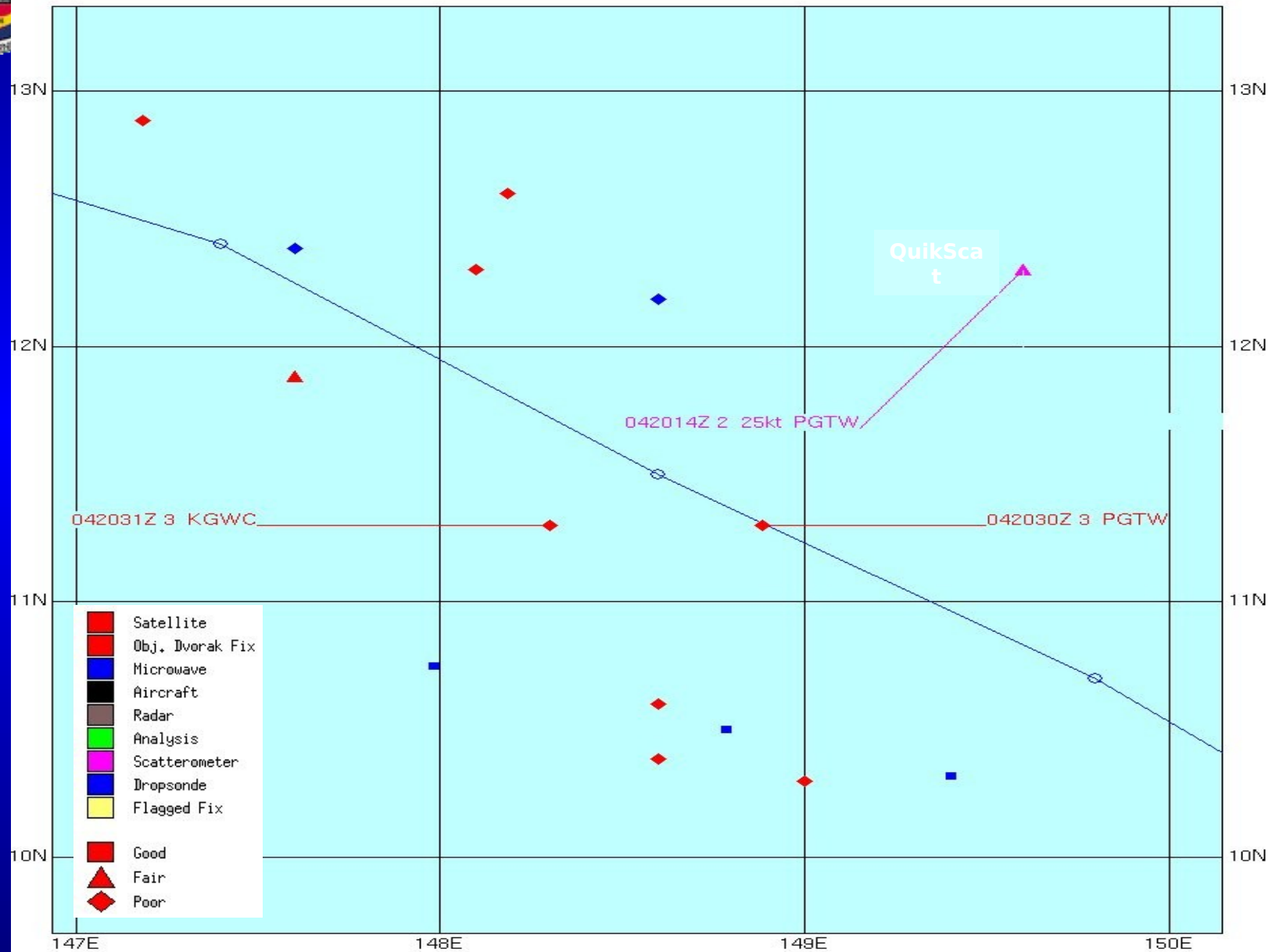
- Best Track, Balance of:
 - ▶ Current Fixes
 - ▶ Smooth Storm Motion
 - ▶ Is it an Eye Wobble or not??
 - ▶ Microwave came in 3 hours later..50 nm off...
- “My forecasts were probably no better or worse than anyone else’s, but I always started in the best spot”

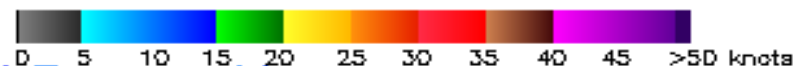
Past TDO, 2004 MSCC



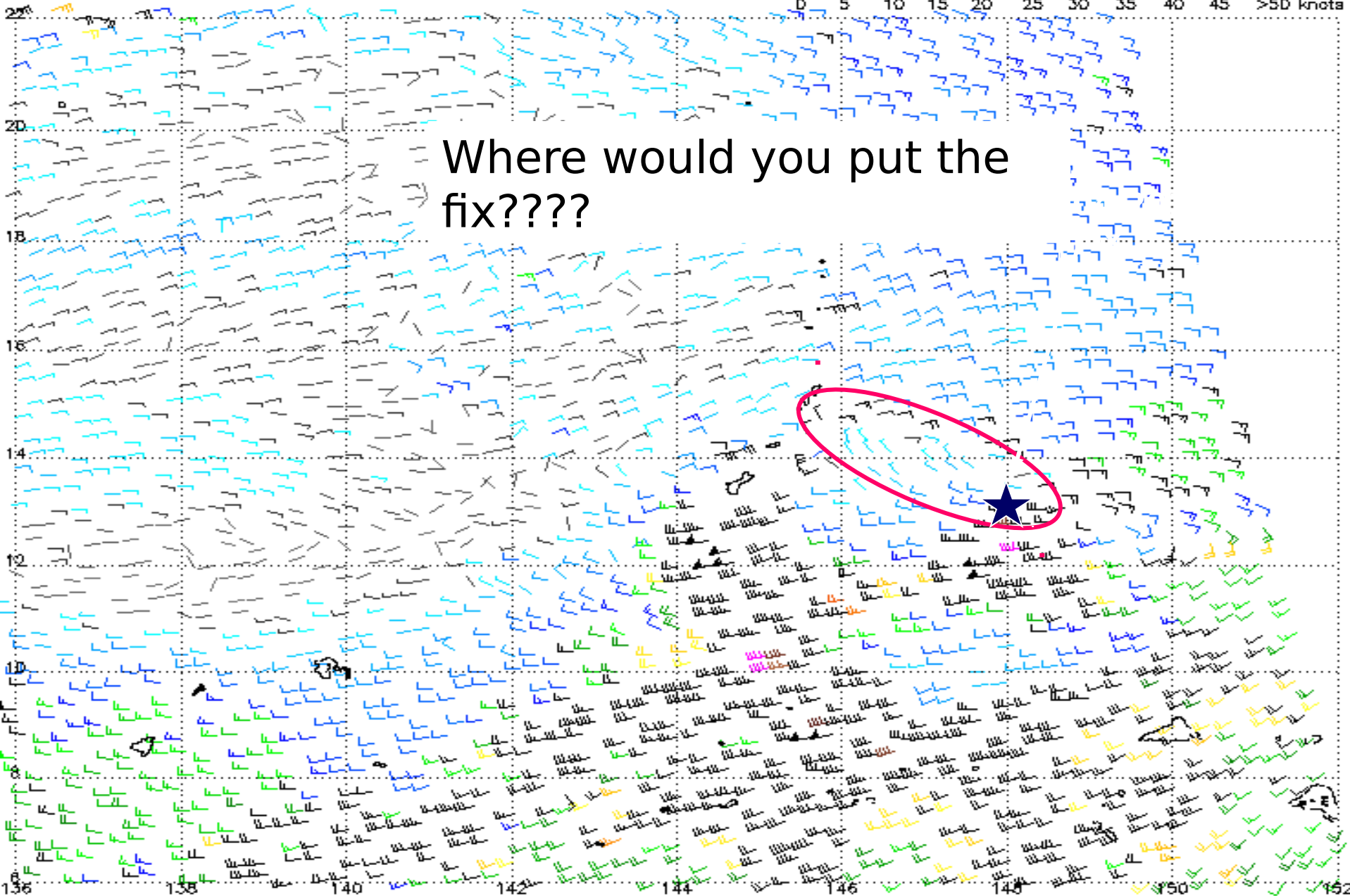


"It's Not Always so Obvious"





Where would you put the fix????



Storm number: 15 Storm name: NONAME

Note: 1) Times are GMT 2) Black barbs indicate possible rain contamination

3) Data buffer is Sep 5 14:42 UTC 2003-22 hrs 4) Data pass times at bottom of image

09/05/03 1800Z 15 NONAME
09/04/03 2211Z SSMI F-14 COMPOSITE
09/04/03 2213Z GOES-9 VIS

148E 20N



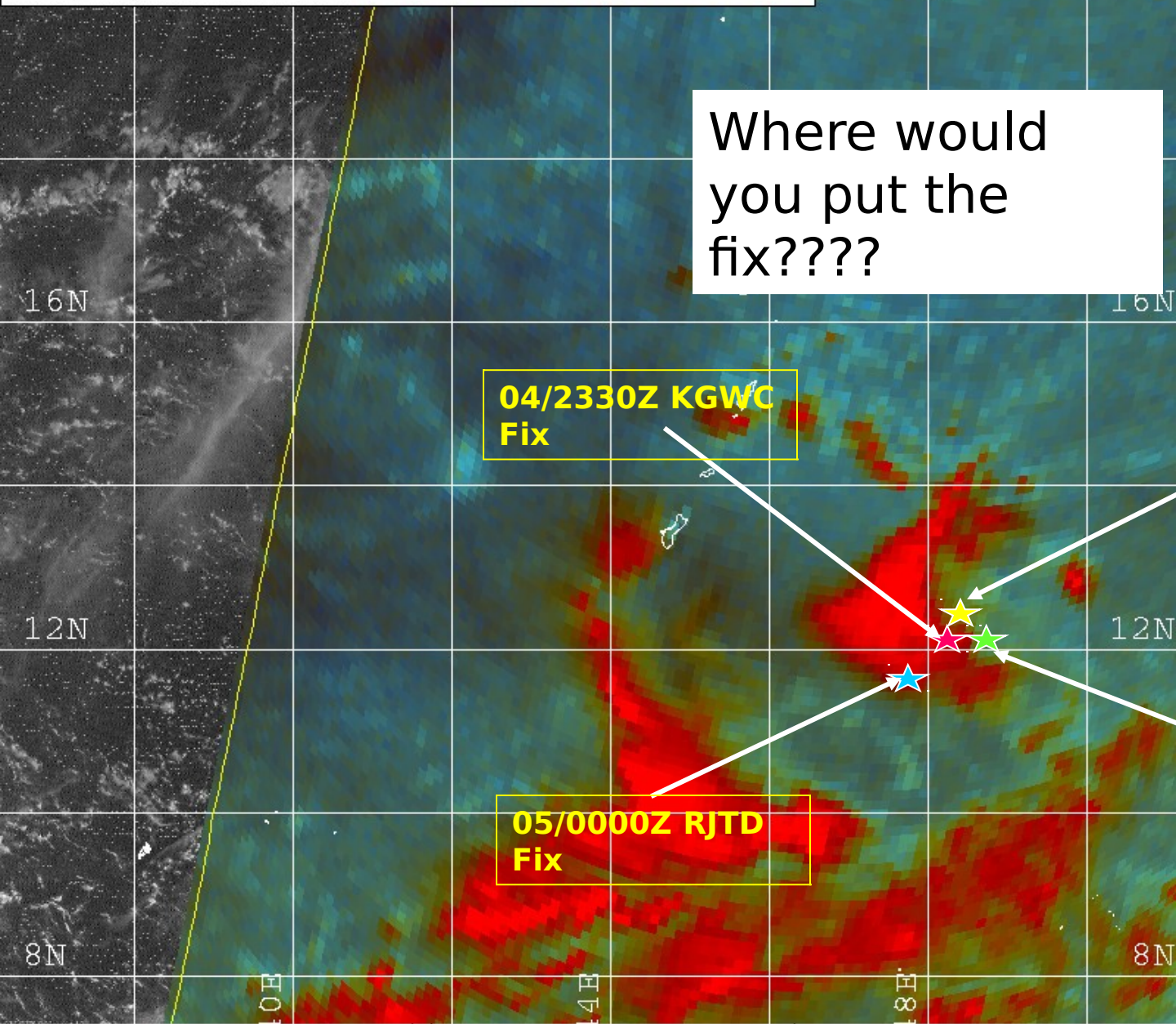
Where would
you put the
fix????

04/2330Z KGWC
Fix

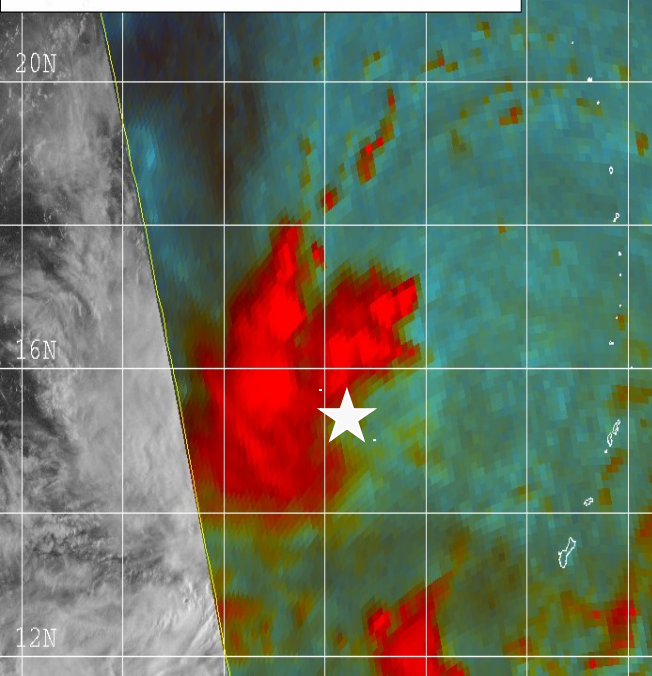
04/ 2330Z
PGTW Fix

04/2211Z SSMI
Fix

05/0000Z RJTD
Fix

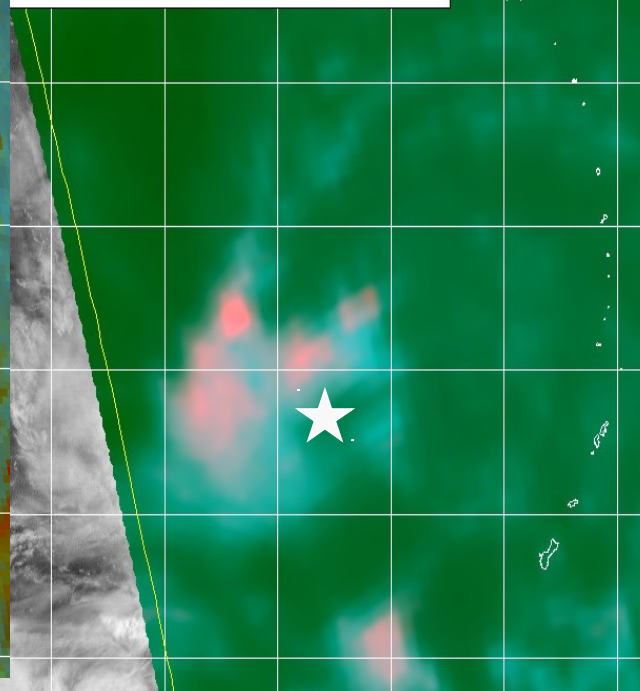


09/06/03 0600Z 15 MAEMI
09/06/03 0837Z SSMI F-13 COMPOSITE
09/06/03 0725Z GOES-9 VIS



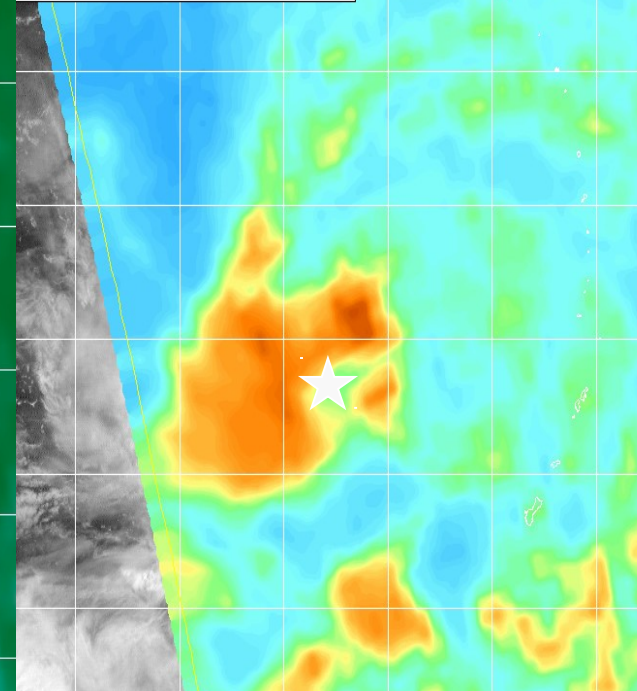
**SSMI 85GHz
Composite**

/03 0600Z 15W MAEMI
/03 0838Z SSMI COMPOSITE37
/03 0601Z GOES-9 VIS



**SSMI 37 GHz
Composite**

06/03 0600Z 15W MAEMI
06/03 0838Z SSMI 37V
06/03 0601Z GOES-9 VIS



**SSMI 37 GHz
Vertical**

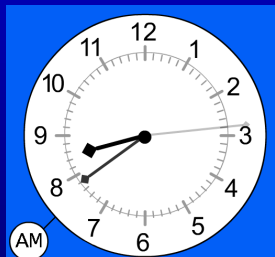
**Where would you
fix at??**

**Did it come in on
time to make a
difference??**



Bogus

- Bogus sent for Suspect Areas classified as a Fair or higher
- Need to evaluate:
 - ▶ Vmax
 - ▶ Rmax
 - ▶ Depth
 - ▶ ROMCI
 - ▶ 35 kt Wind Radii
 - ▶ 50 kt Wind Radii



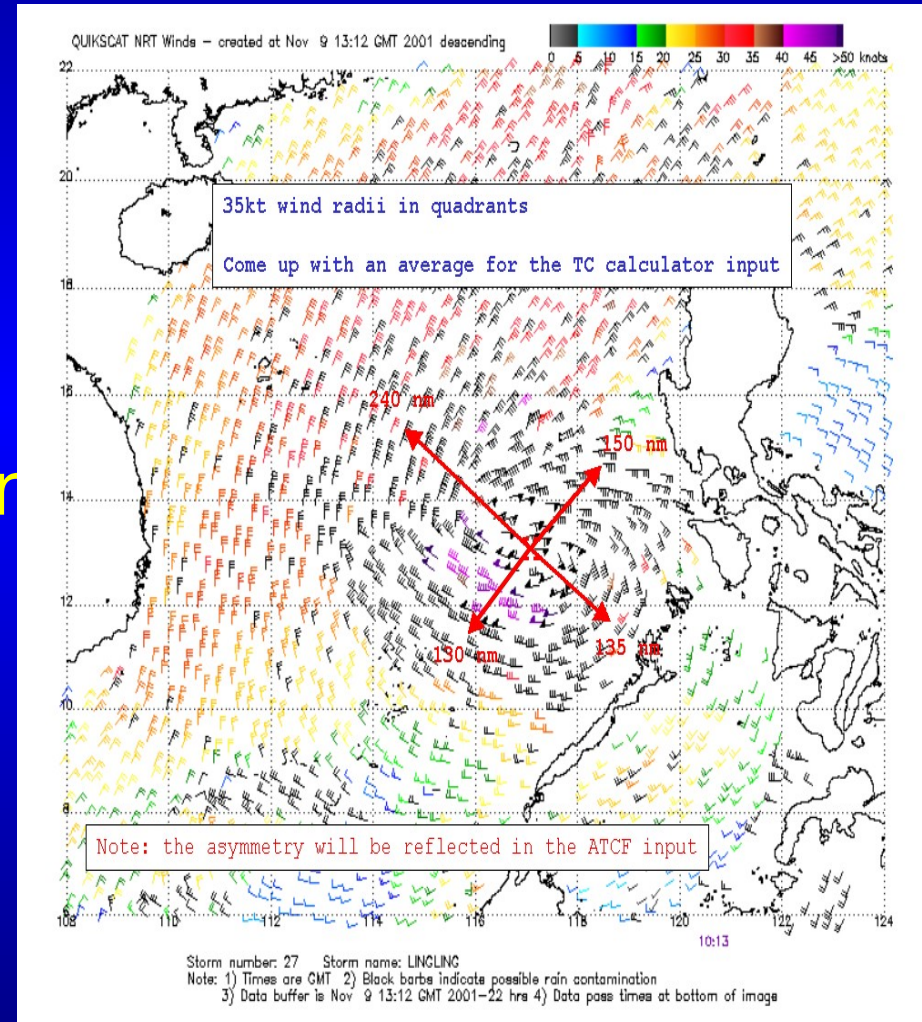
		Log = atcf.boguslog	
		by: LT Wingard/LTJG Roberts	
		21/06Z Bogus	
		NAME	VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT
		12W	140 20 D 1005 120 145NE/120/85SW 80E/75W
		14W	40 30 M 1006 110 60NE/50NW/40S --
		13W	30 40 S 1006 120 -- --
1332	07/21/2002 04:31 Z		
		by: LT Wingard/LTJG Roberts	
		21/00Z Bogus	
		NAME	VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT
		12W	140 20 D 1005 120 145NE/120/85SW 80E/75W
		14W	35 40 S 1008 90 -- --
		15W	30 40 M 1009 120 -- --
		13W	35 40 S 1006 120 -- --
1331	07/21/2002 00:23 Z		
		by: leejoice	
		20/18Z Bogus	
		NAME	VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT
		12W	140 20 D 1005 120 145NE/120/85SW 80E/75W
		13W	35 40 S 1006 120 -- --
		14W	30 40 S 1008 90 -- --
		15W	35 40 M 1009 120 130SE/130NE/100W --
1330	07/20/2002 17:48 Z		
		by: leejoicer	



Determining Wind Radii Using Quikscat



- † Many different ways to determine parameters
- † Using Quikscat for TC 27 W

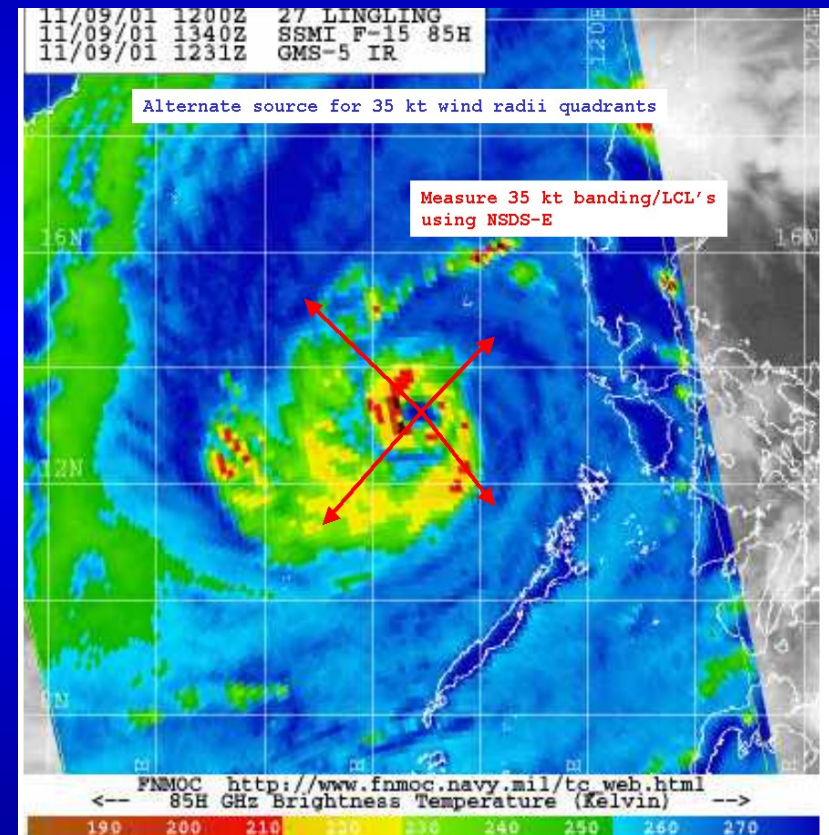




Determining Wind Radii using Microwave



- Using 85 GHz Microwave for determining the Bogus for TC 27W
- Validates TDO radii





WxMap (NOGAPS, AVN and UKMO)

[2004081218](#)

[2004081212](#)

[2004081206](#)

[2004081200](#)

[2004081118](#)

[2004081112](#)

[16W](#)

[17W](#)

[91W](#)

[96E](#)

[AVN](#)

[NGP](#)

[000](#)

[024](#)

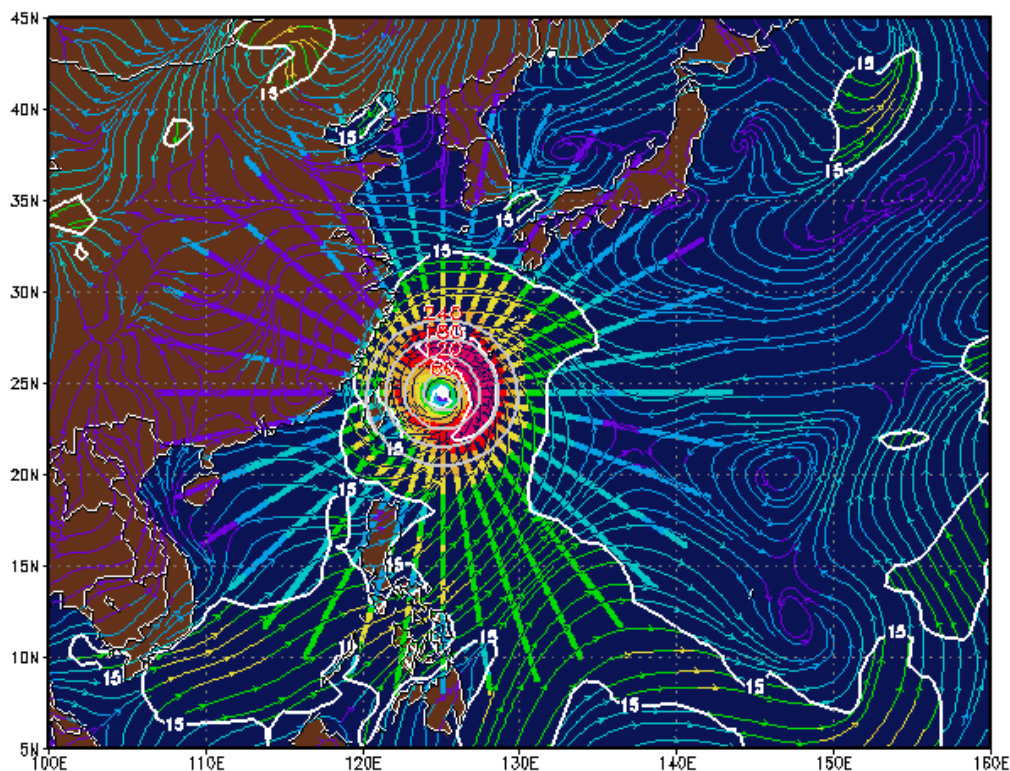
[048](#)

[072](#)

[animate](#)

[profile](#)

AVN V_{max} for: 16W at: 2004081112 tau = 000
CARQ: $V_{max}=85$ kt $R_{max}=9$ nm $R_{34}=100$ nm $R_{50}=30$ nm



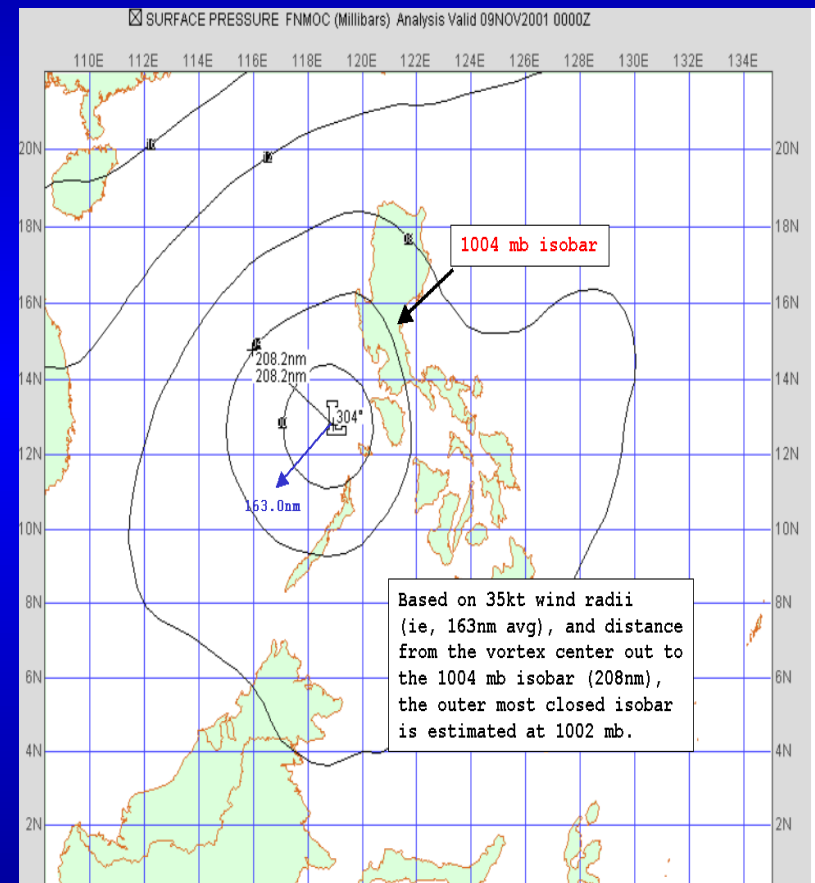
2004-08-11-08:52



Determining the ROMCI



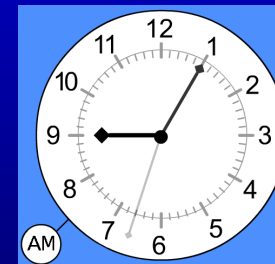
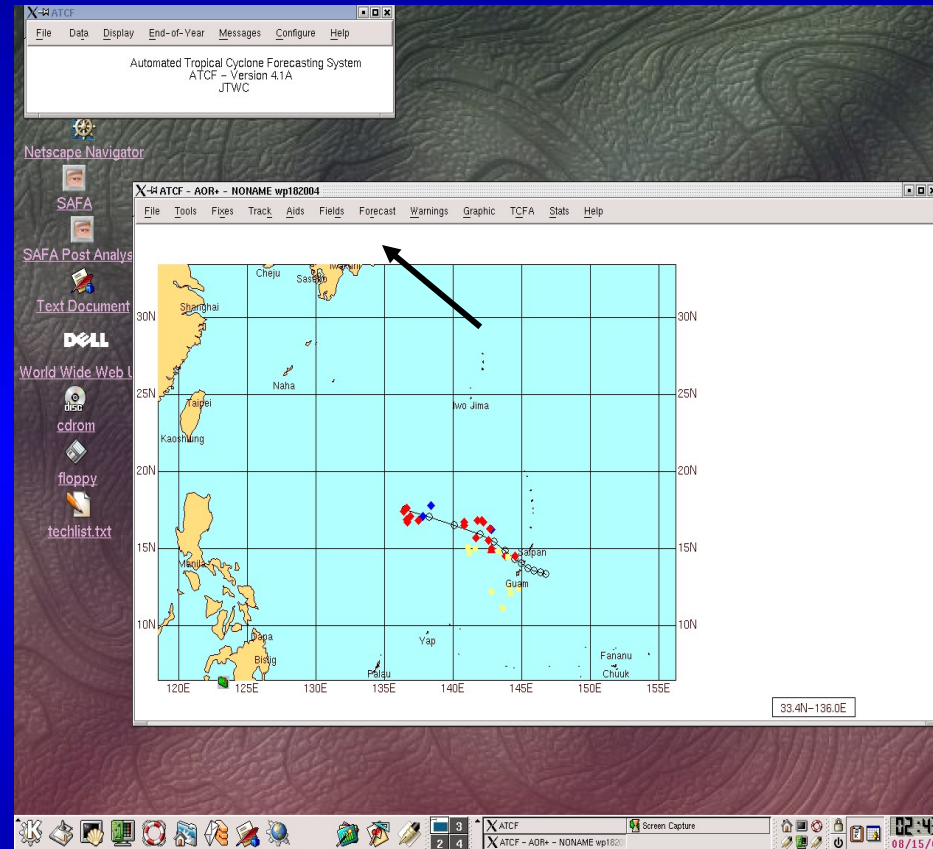
- Using Sfc MSLP Analysis to Determine ROMCI





Time to Forecast

- System has been:
 - Fixed
 - Rebased
 - Bogused
- Time to warn
- Need to:
 - ▶ Get Objective Aid Fields
 - ▶ Run Objective Aid Fields
 - Trackers Translated to Best Track
 - CONs are computed
 - Output sent to SAFA
- SAFA analysis/discussion

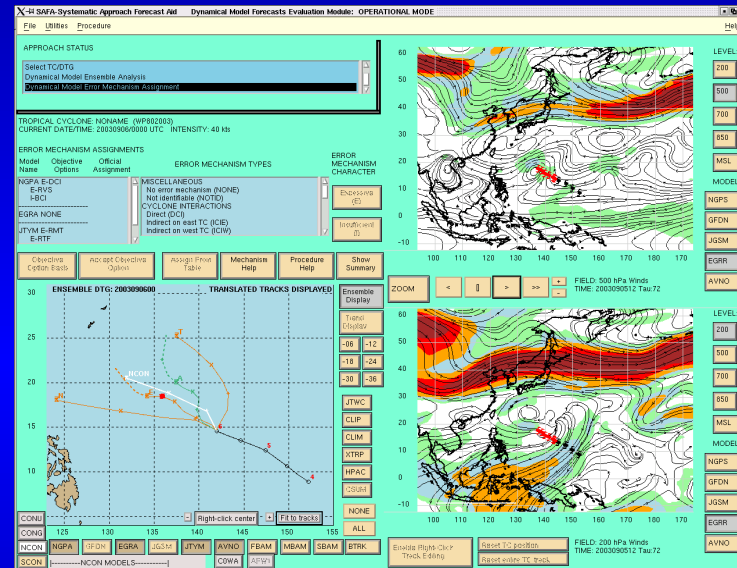




Systematic Approach to Forecasting (SAFA)

Systematic Training For Intensity Forecasting

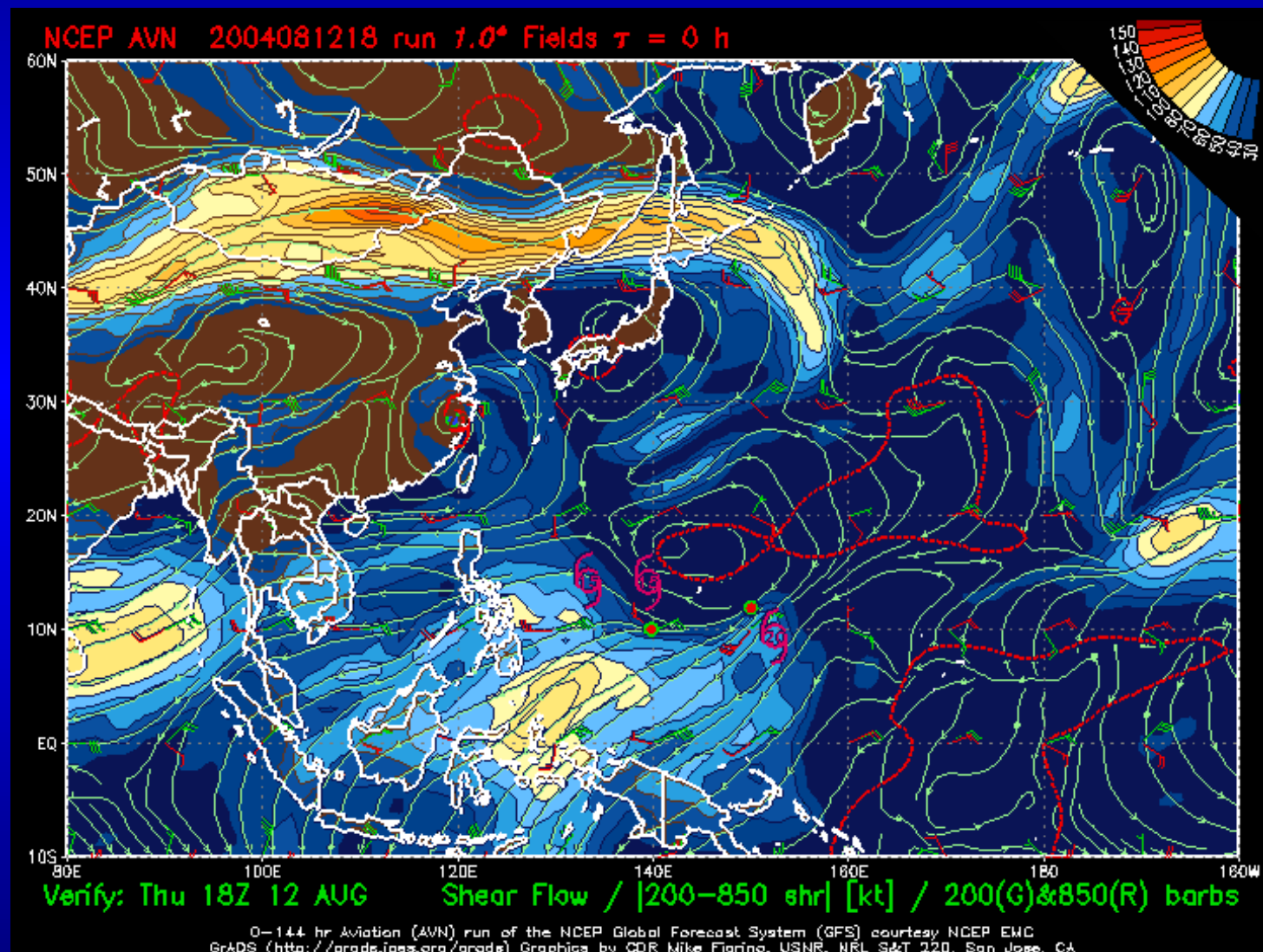
<ul style="list-style-type: none"> Model Guidance <ul style="list-style-type: none"> Principles of TC motion Patterns and region classifications Use of imagery to understand the environment Transfer of knowledge Standardization of forecast process. 	<p>Consensus</p> <ul style="list-style-type: none"> Consensus is first guess for all forecasts. TC's <55 kts and undergoing ET are problems for consensus.
<p>Rules of Engagement</p> <ul style="list-style-type: none"> Make sure all possible CONW members are entered. If spread is large review and understand all model predictions Don't dismiss model predictions unless freq error mechanism is present. Position the JTWC 72h posit within 120 nm of CONW unless approved by J TOPS. 	<p>Problems</p> <ul style="list-style-type: none"> Frequent Error Mechanisms are no longer evident in fields. Continuous changes in consensus make individual model tendencies too hard to manage. Need to look at situations where consensus typically fails (>225nm error) to update TDO training



- Use of imagery to understand the environment
- Standardizes the JTWC forecast process
- Model comparisons, current synoptic regime, current and future outflow, current and future wind shear



WxMap (NOGAPS, AVN and UKMO)

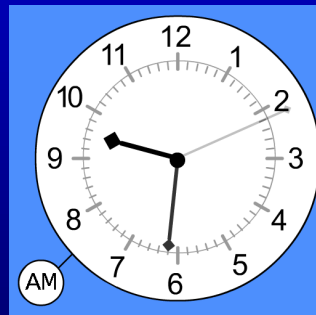
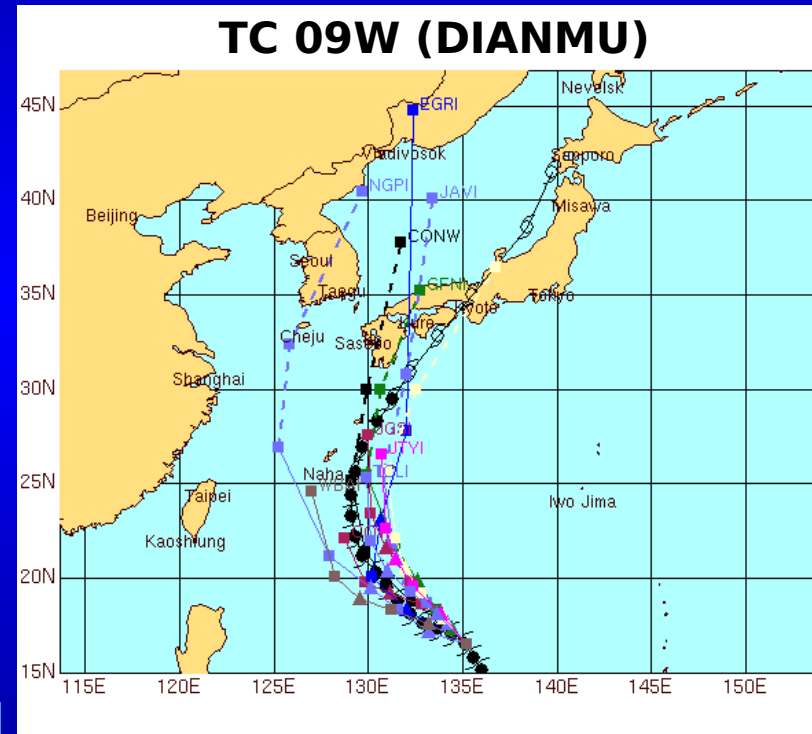




Forecasting The Track

- Currently utilize a Consensus of Dynamic Models
- CONW is the starting point
- Adjustments made after SAFA analysis

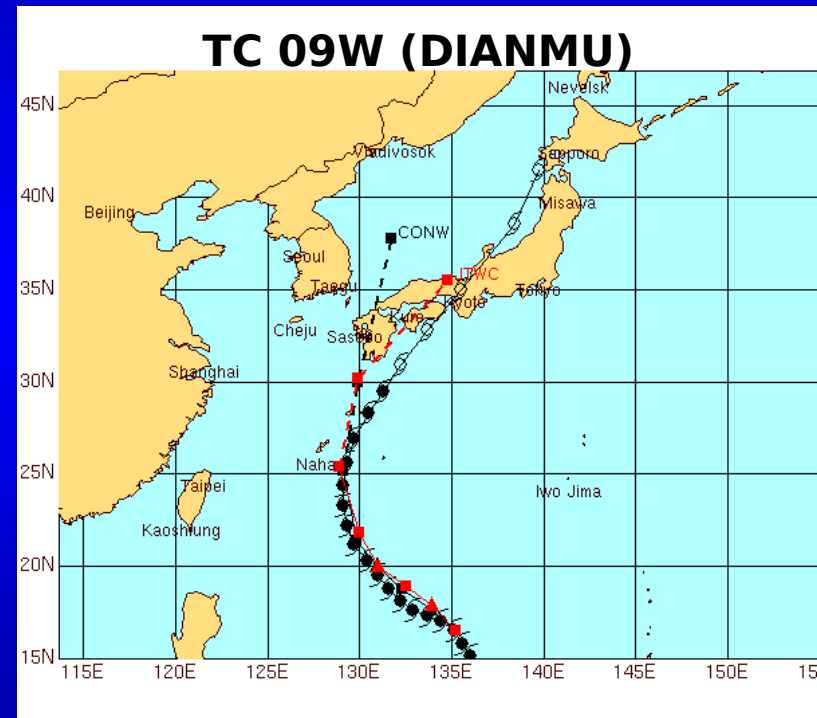
What would your forecast be?





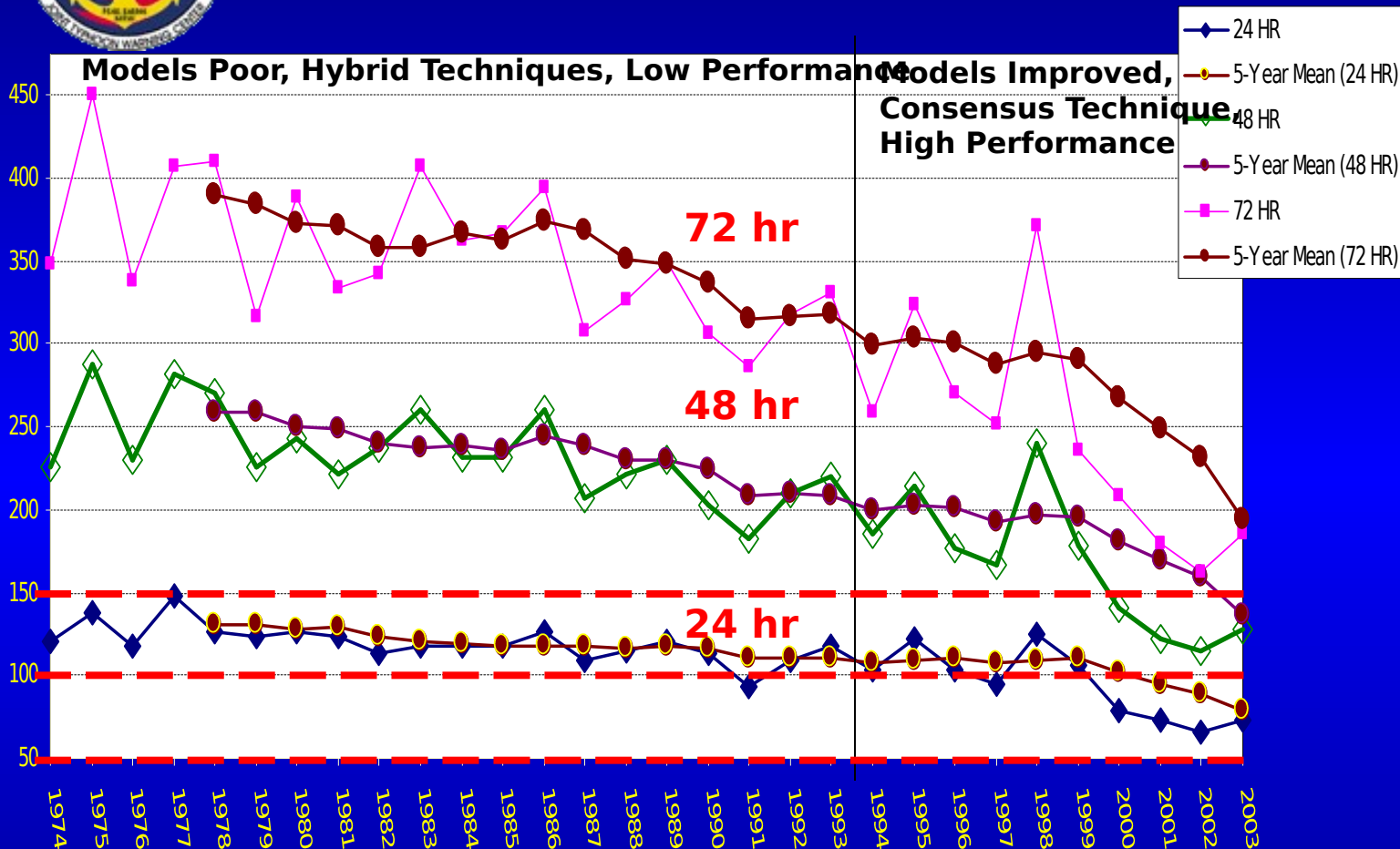
JTWC Forecast

- NOGAPS was recognized to have E-DCI with a low in Yellow Sea and discounted
- Forecast was east of CONW
- Value added to 120 hour TAU





JTWC Position Error Trend



120hr

2000: 325nm

2001: 419nm

2002: 278nm

2003: 297nm

2004: 229nm

72hr

2000: 209nm

2001: 180nm

2002: 162nm

2003: 185nm

2004: 165nm

48hr

2000: 142nm

2001: 118nm

2002: 115nm

2003: 128nm

2004: 124nm

24hr

2000: 81nm

2001: 70nm

2002: 66nm

2003: 73nm

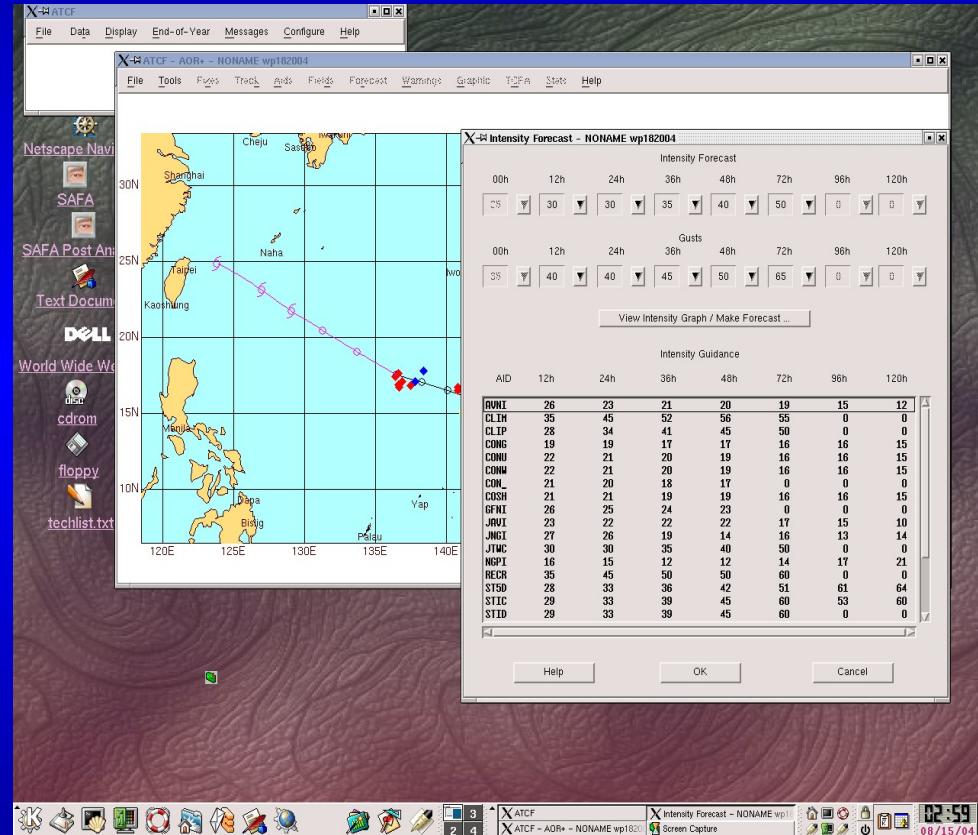
2004: 69nm



Forecasting Intensity



- Analyzed Upper Air Chart
- University of Wisconsin (UW) CIMSS Product Suite
- SAFA
- Customized Model Fields in WxMap
 - ▶ TC Structure
- Statistical Guidance
 - ▶ MIT CHIPS
 - ▶ CSU CIRA ST5D/STIPS
 - Statistical/Dynamic Model

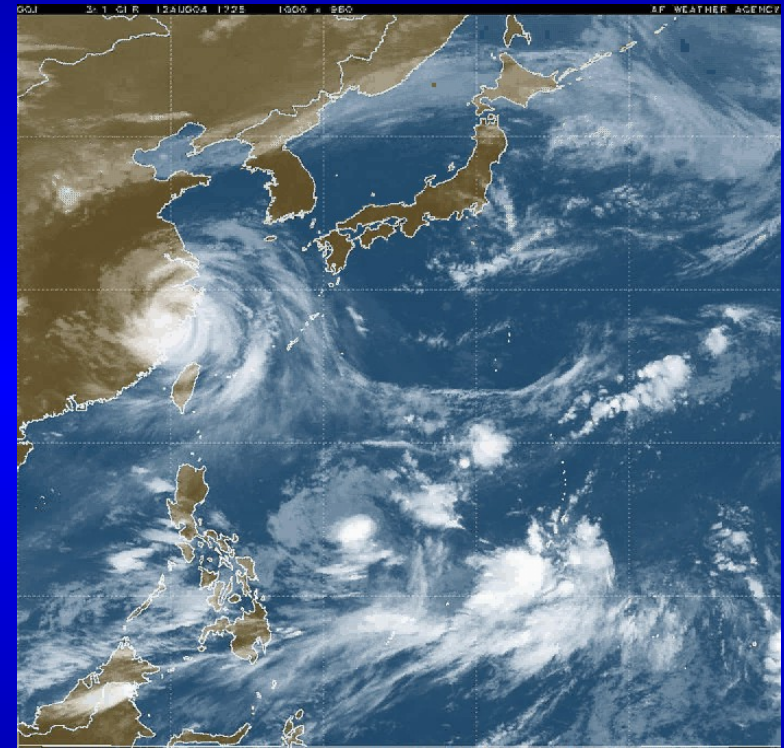




Intensity Tools at JTWC

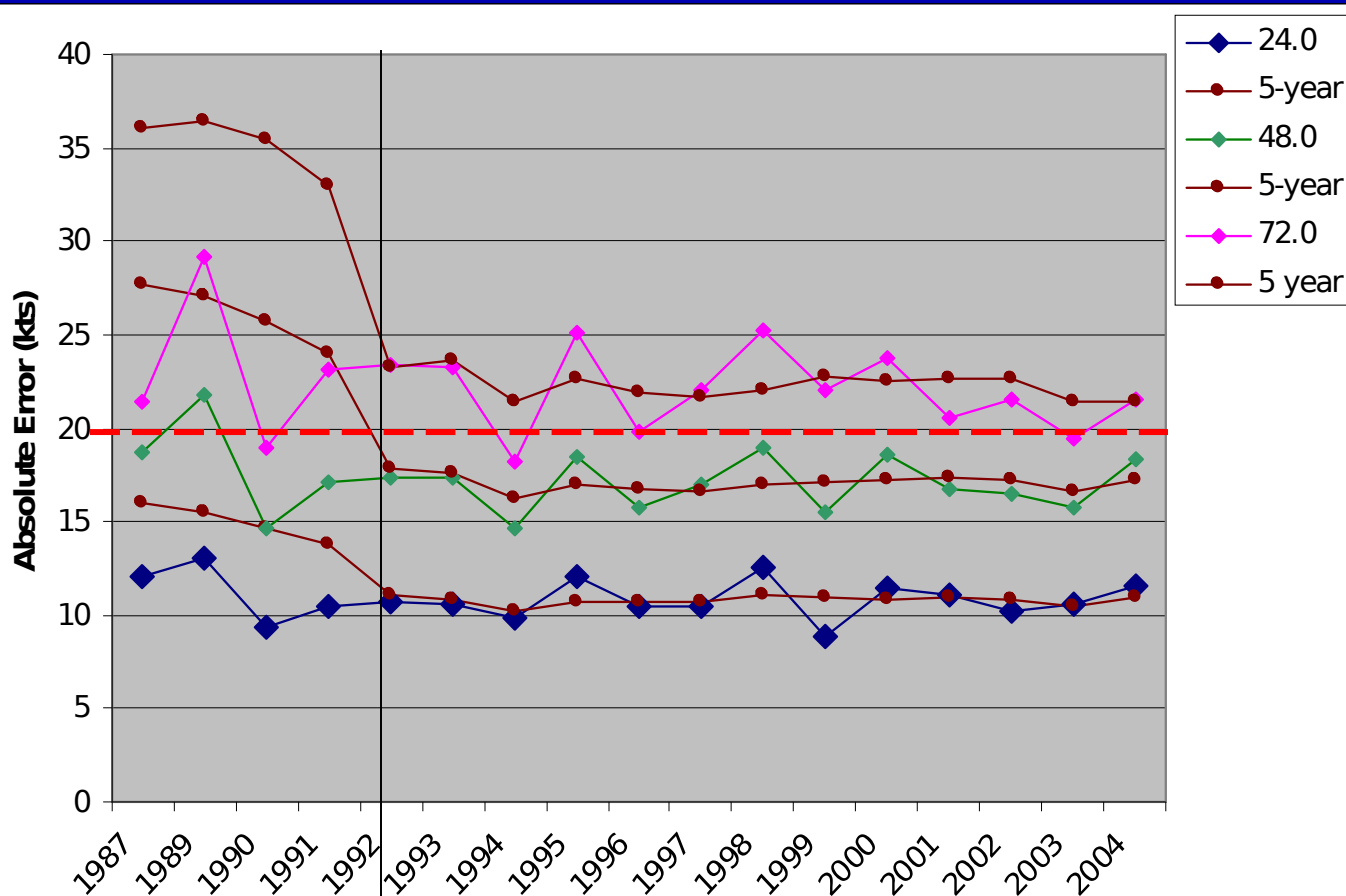


- Experimental vertical shear TC intensity trend estimate
 - ▶ UW-CIMSS
- Consensus Guidance
 - ▶ ICON
- Intensity analysis & forecast checklists
- Intensity 1st guess guidance
- Satellite data loop





FORECAST INTENSITY MEAN ABSOLUTE ERRORS



120hr

2003: 19kts

2004: **27kts**

72hr

2000: 24kts

2001: 21kts

2002: 20kts

2003: 20kts

2004: **22kts**

48hr

2000: 19kts

2001: 17kts

2002: 16kts

2003: 16kts

2004: **18kts**

24hr

2000: 12kts

2001: 11kts

2002: 10kts

2003: 11kts

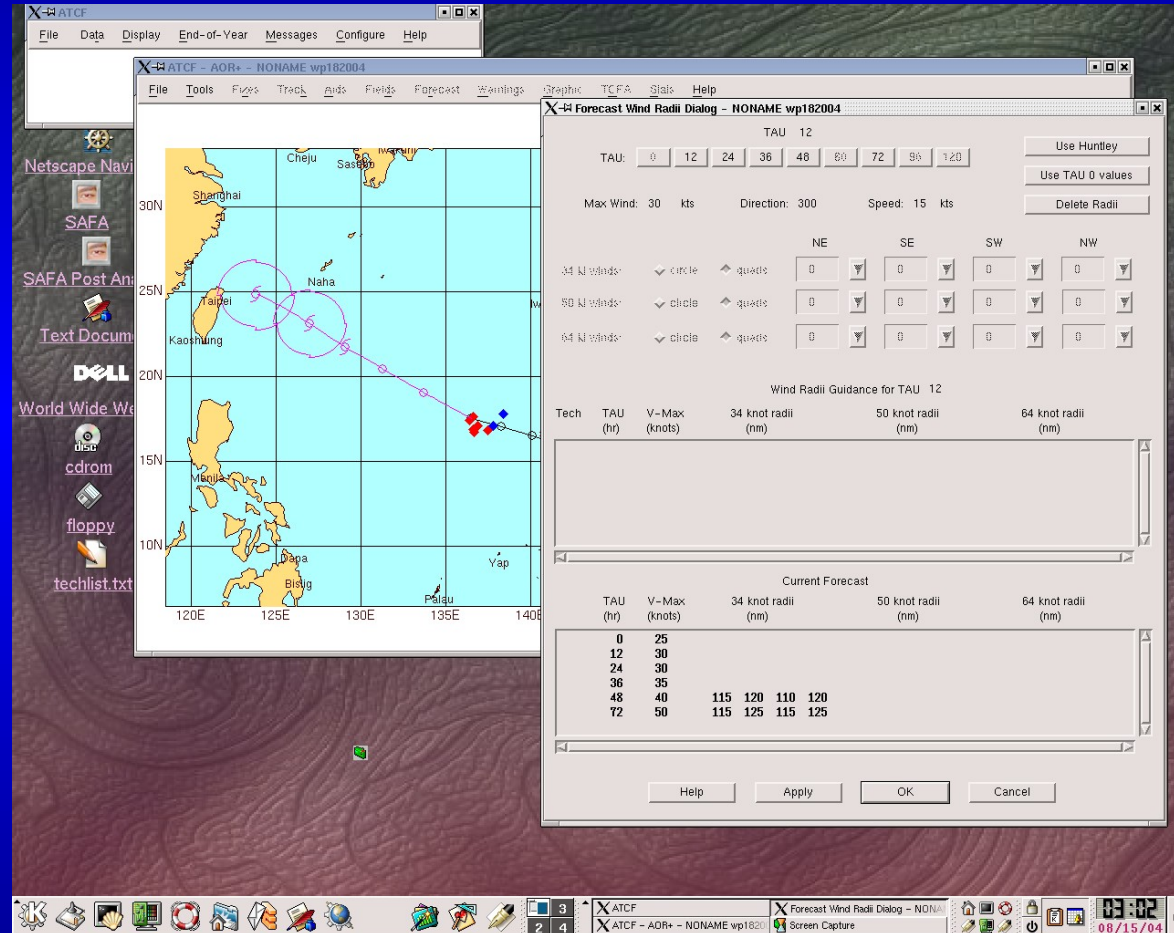
2004: **12kts**



Creating the Wind Radii



- DCRL
- Quikscat
- Microwave
- Storm motion
- Wx Map
 - ▶ TC Structure

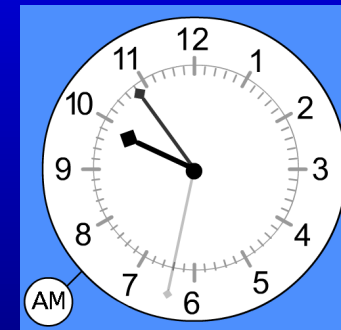
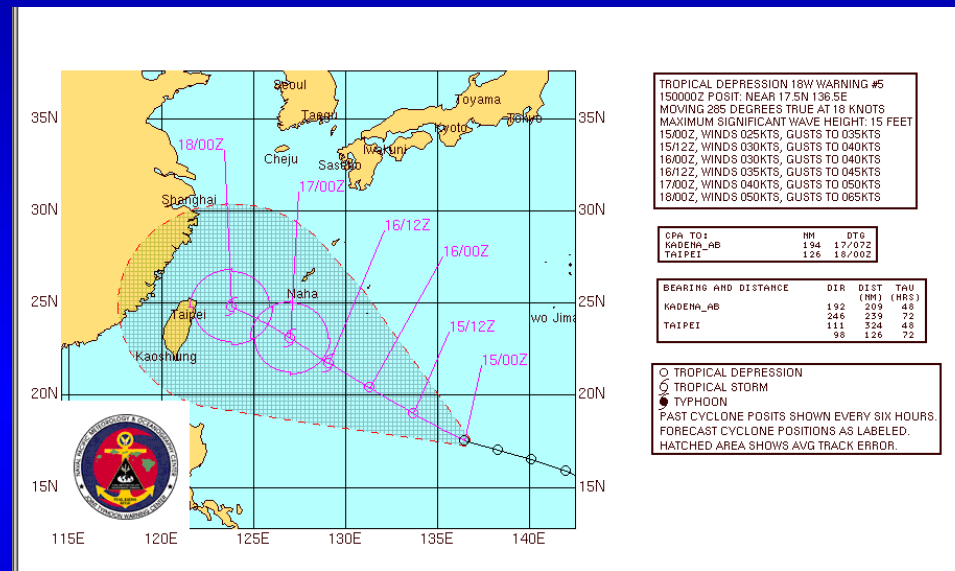




Issuing the JTWC Forecast



- Prog reasoning to be completed
- TDA posts to DMS and Web Page
- Repeat for Storm #2 and #3
 - ▶ Prioritize warning wrt ops impact
- All warnings in customers hands NLT 2.5 hours from synoptic time
 - ▶ 1030L
- Compute and post CPA's
- Customer Notification
- Conference Calls

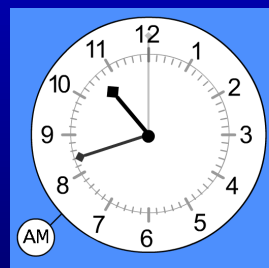
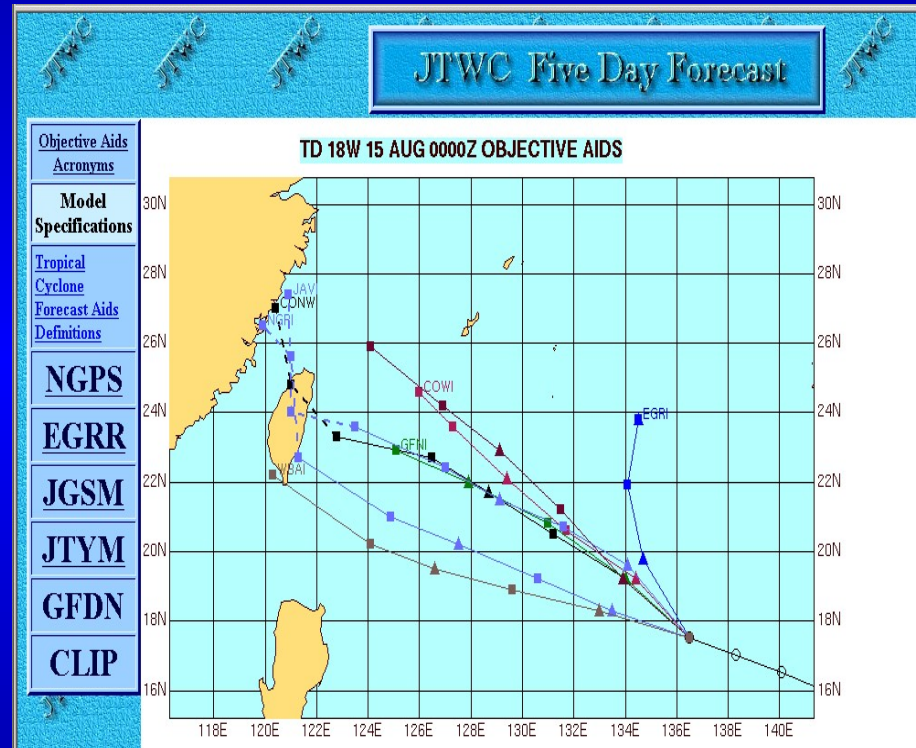




Posting the 5 day Aids



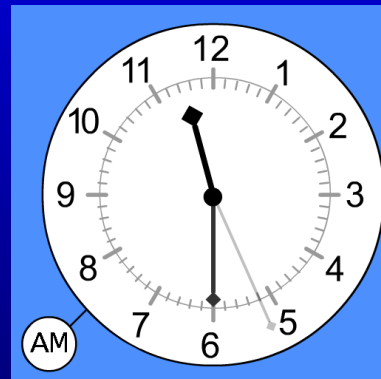
- Available to METOC only
- Time consuming posting process
- Working on a script based upload tool
- Must be pulled from JTWC data server





Conference Call

- Conference calls with customers during high profile WESTPAC cyclones
- Usually when interest is high and phones ringing off the hook





After 1130L....

- MetWatch for new developments
 - ▶ Upgrade Significant Weather Advisories as necessary
- Monitor off-time fixes
- New analysis of atmosphere
 - ▶ Models, CIMSS, Microwave, Quikscat, Other Agencies
- Prep Prog Reasoning bulletin for second warning cycle
- Maybe....
 - ▶ Restroom
 - ▶ Lunch



It's 1400L, start again.....

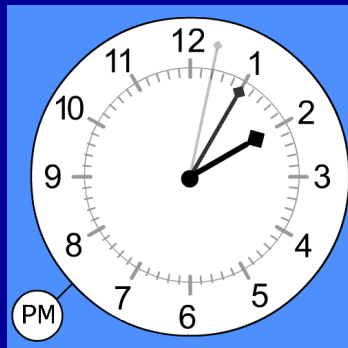


1200L Perform streamline analyses, look for suspect areas, review old data and previous forecasts, issue sig wx bulletin(s)

1400 L Start 0000 UTC Warning
1630 L Issue 0000 UTC Warning
1645L Prog Reasoning
1700L Shift Change

Warning Crunch

Review fixes
Update BT
Send Bogus
Create Consensus
SAFA Analysis
Intensity Assessment
Wind Radii
Create Warnings
Issue Warnings
5 Day Aids
Customer Calls





“IF....”

- If all storms were well behaved.....
- “They never.....”



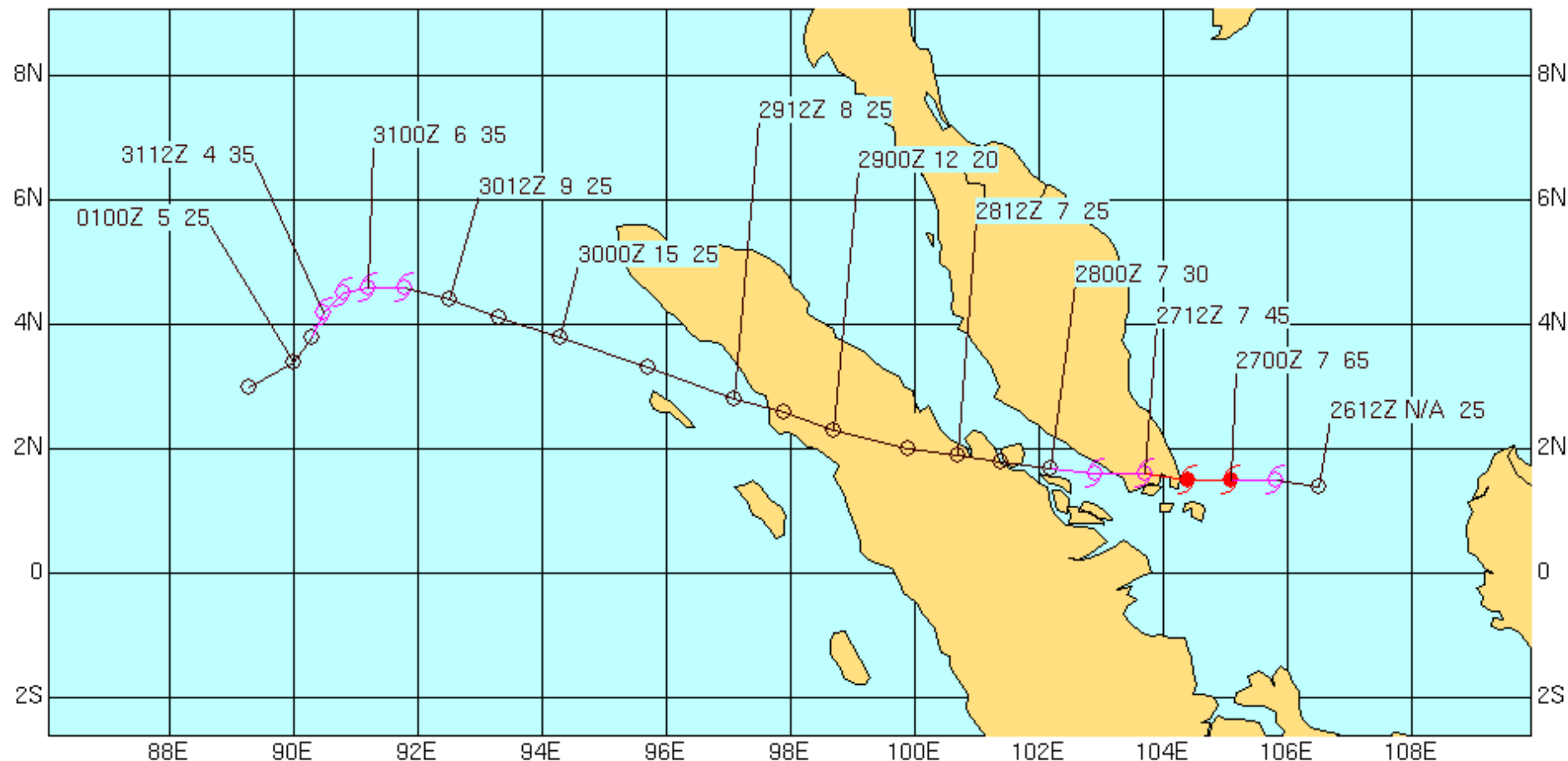


Typhoon 32W (Vamei)

26 Nov – 01 Dec 2001



They “Never” track towards the equator towards an aircraft carrier!

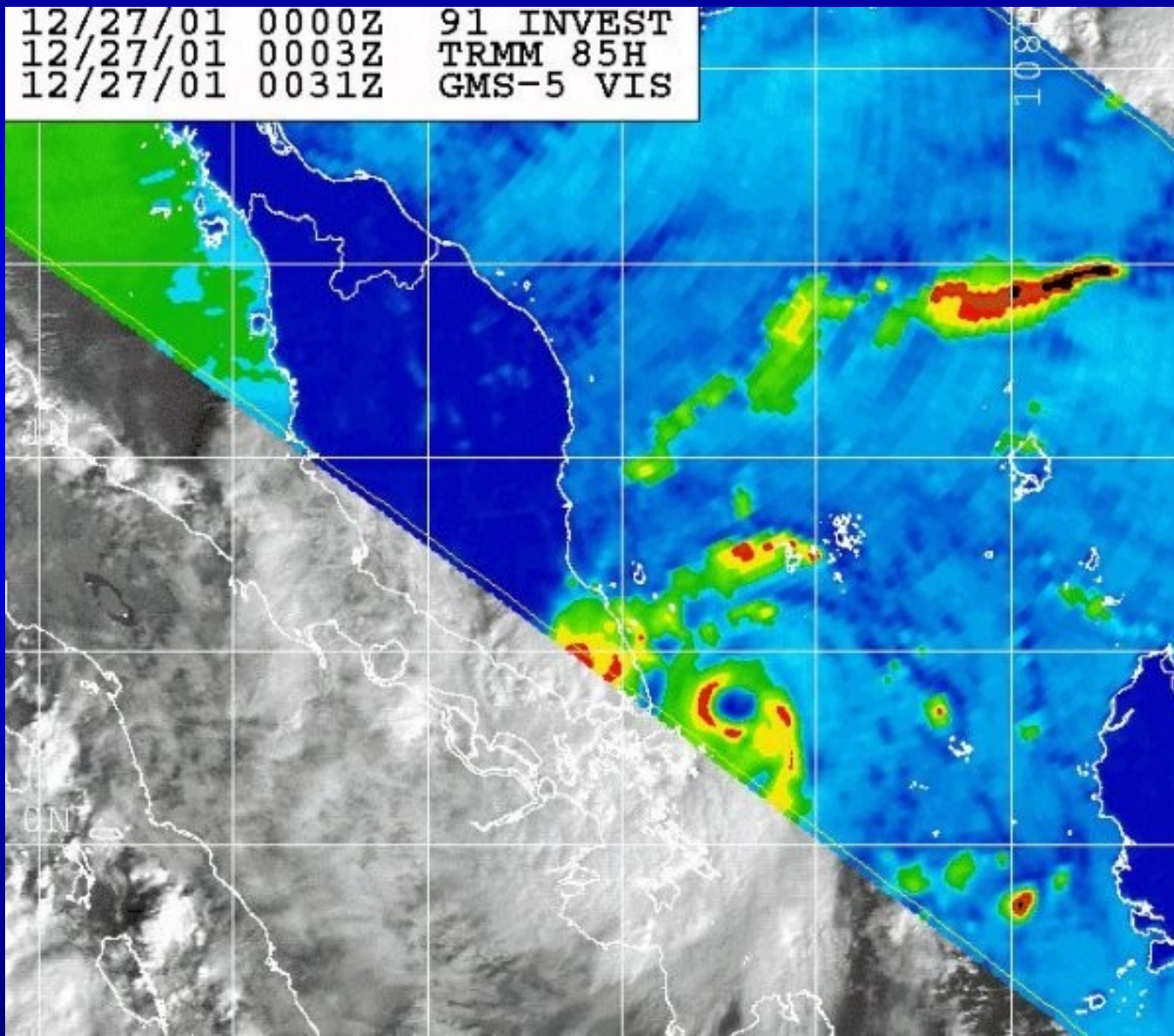




Typhoon 32W (Vamei) Cont'd



12/27/01	0000Z	91 INVEST
12/27/01	0003Z	TRMM 85H
12/27/01	0031Z	GMS-5 VIS





Eye NE of USS
Carl Vinson



Typhoon 32W (Vamei)
Radar Data fm USS Carl
Vinson

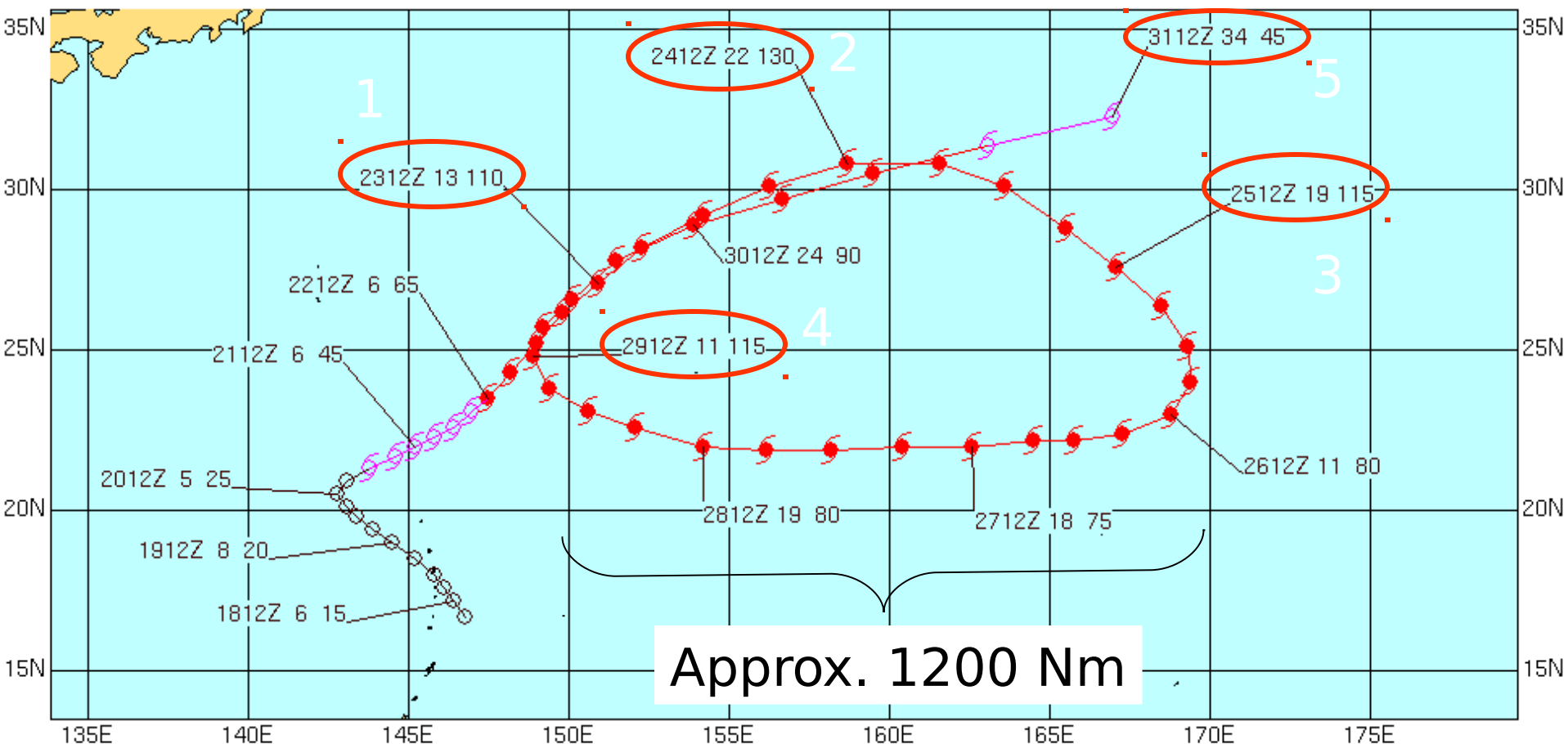
Eye SW of USS
Carl Vinson





Typhoon 21W (Parma) 18 Oct - 31 Oct 2003

They "Never" do a 1200 nm loop....with a double intensity max!



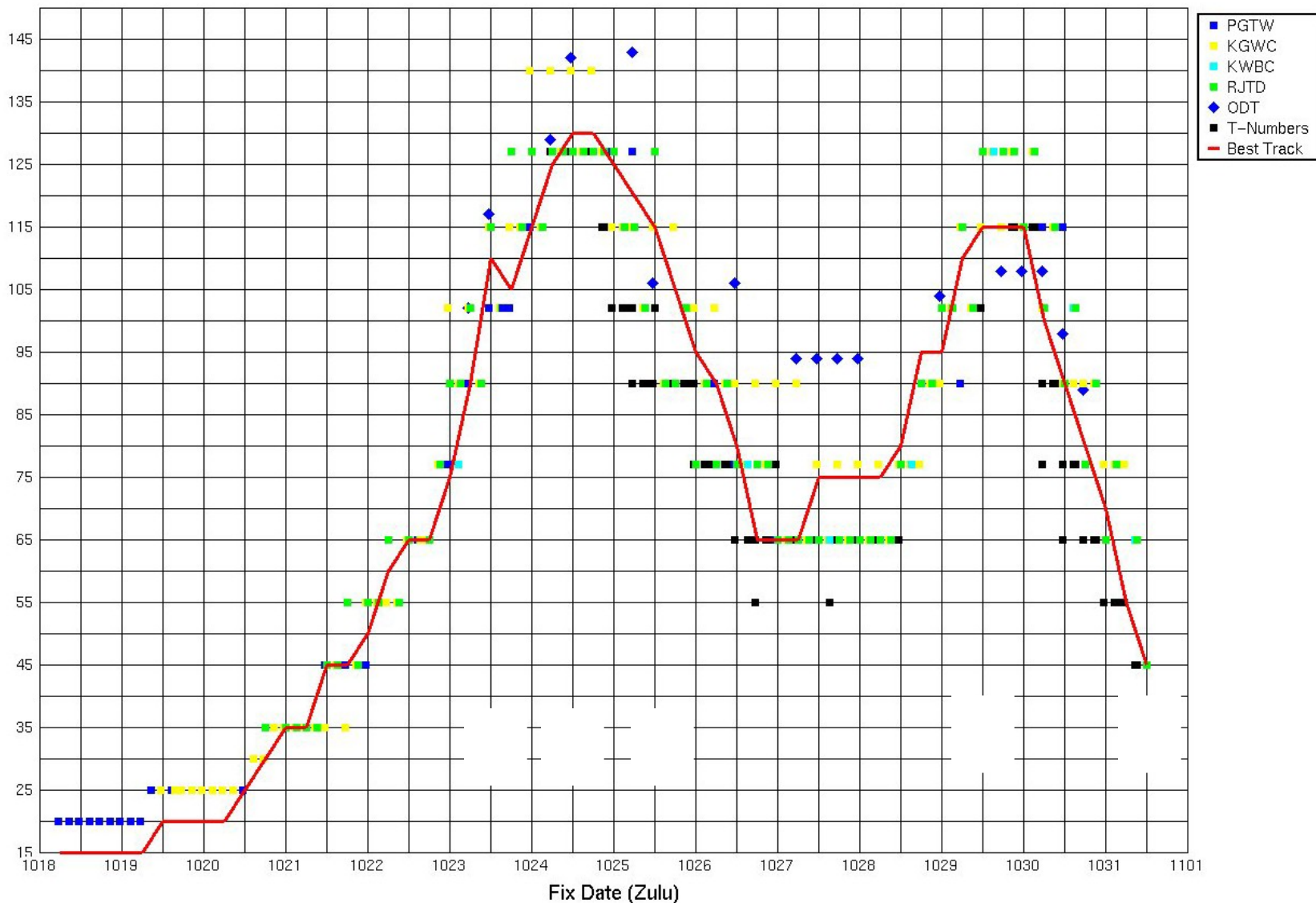


Typhoon 21W (Parma)

18 Oct - 31 Oct 2003



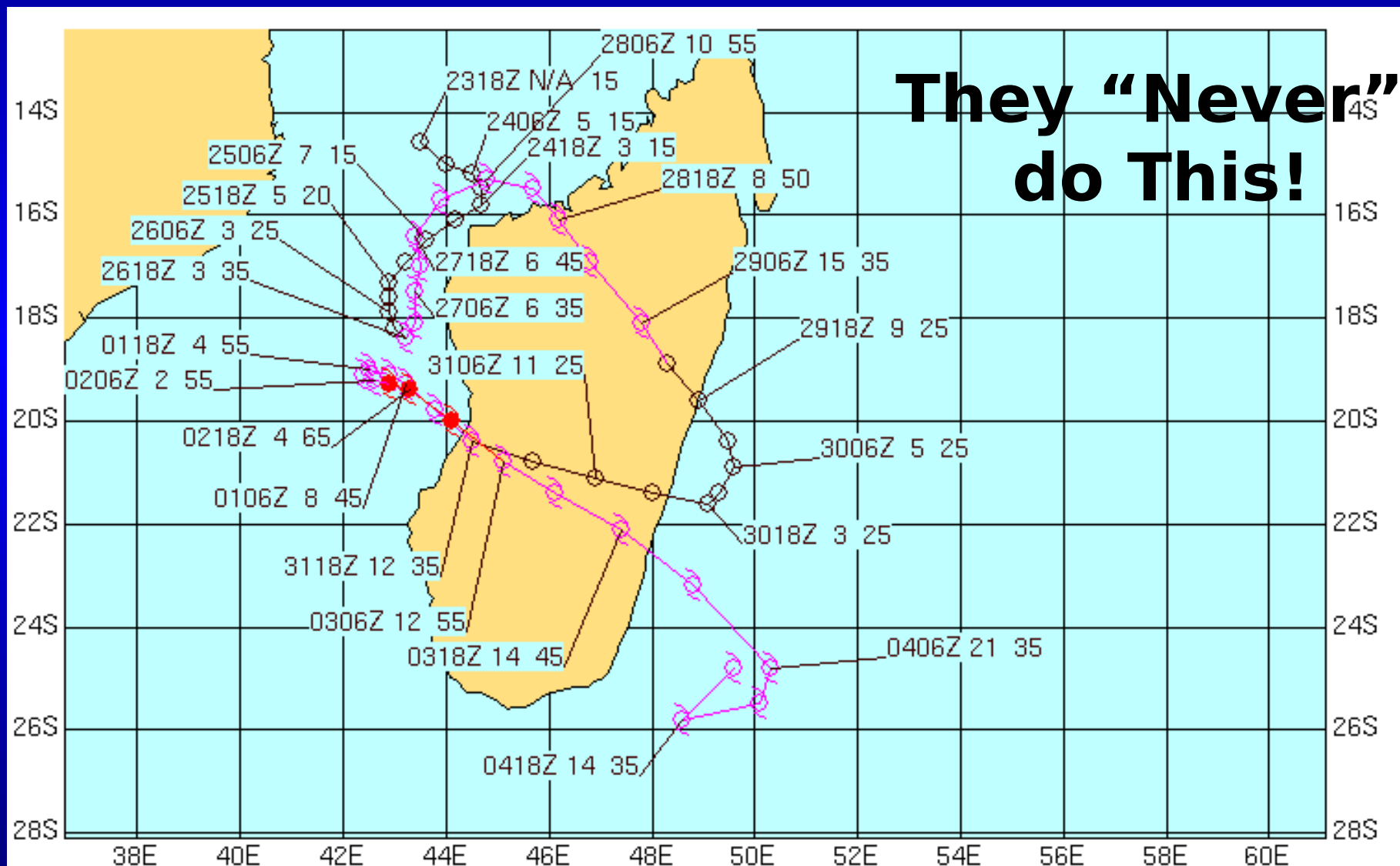
Intensity (kts)





Tropical Cyclone 09S (Elita)

23 Jan - 05 Feb 2004





At JTWC, You Learn to....



- Never say “Never” Again

